

Elevation of Plasma NT-proBNP Concentration in a Korean Jindo Dog Infected with *Dirofilaria immitis*

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Abstract : The aim of this study is to report the observed elevation of plasma N-terminal pro-B-type natriuretic peptide (NT proBNP) concentration in a Korean Jindo Dog infected with *Dirofilaria immitis*. Evaluation of the animal included physical examination, thoracic radiography, ELISA kit (PetCheck[®], IDEXX Laboratories, USA) test and plasma NT-proBNP evaluation. The infected animal's NT-proBNP concentration was compared with those of 5 normal dogs of the same age, sex, and breed; the affected Korean Jindo dog had increased plasma NT-proBNP. To the best of our knowledge, this is the first report of NT-proBNP elevation in a Korean Jindo dog with dirofilariasis.

Key words : *Dirofilaria immitis*, NT proBNP, dog.

Introduction

Canine heartworm disease is caused by the filarial nematode *Dirofilaria (D.) immitis*. The roundworm resides in the pulmonary arteries, and occasionally the right heart chambers, of dogs, cats, ferrets and wild canids (1,8), and its clinical manifestations include thromboembolism, pulmonary hypertension, right-sided congestive heart failure, and ascites (2,9).

Biomarkers of cardiac injury are widely used in human medicine, and their importance in veterinary medicine has become evident in recent years (3). The N-terminal pro-B-type natriuretic peptide (NT-proBNP) is present at high concentrations in cardiac myocytes and is released into the blood-stream with cardiac injury (3,6). Elevated NT-proBNP concentrations are seen in dogs with heart disease and heart failure, and NT-proBNP testing can be used to help diagnose heart disease and to distinguish the underlying cause of respiratory abnormalities in dogs (5).

The aim of this report is to describe our experience with a Korean Jindo Dog with severe *D. immitis* infection and elevated plasma NT proBNP.

Case

A 2-year-old female Korean Jindo dog was referred to the Veterinary Medical Teaching Hospital of Chungnam National University in Daejeon city, Korea, with a history of respiratory distress, exercise intolerance, and anorexia. Physical exami-

nation, urinalysis, and thoracic radiography were conducted, and a blood sample was drawn to assess the complete blood test (VetABC; HESKA, France), blood chemistry profile (Vetscan; Abaxis Inc, Union city, CA, USA), enzyme-linked immunosorbent assay (ELISA) test, and plasma NT-proBNP concentration (Cadiopet proBNP; IDEXX Laboratories Inc., Westbrook, ME, USA).

The sample was examined for circulating antigens of *D. immitis* using a commercial ELISA kit (PetCheck[®], IDEXX Laboratories, USA), according to the manufacturer's instructions. The dog was positive reaction using by Canine Heartworm Antigen Test (PetCheck[®], IDEXX Laboratories, USA). On physical examination, tachycardia was noted (heart rate > 170 beats per minute), and a cardiac murmur and cyanosis were noted. Mild anemia and eosinophilia were noted, along

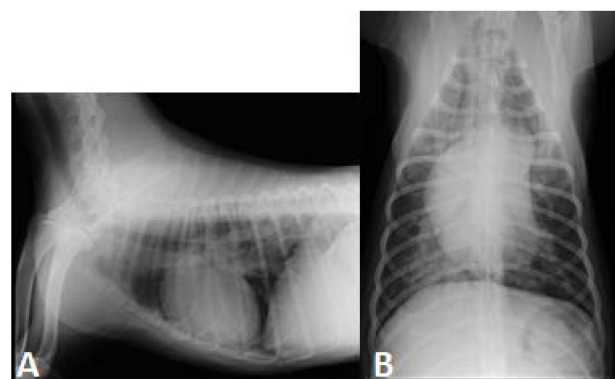


Fig 1. Radiographic examination showed pulmonary trunk bulge and tortuous pulmonary arteries, (A: lateral view B: ventrodorsal view).

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Table 1. Plasma NT-proBNP concentrations in a dog with heartworm disease and 5 control dogs of the same age and breed (mean \pm SD)

Plasma NT-proBNP (pmol/L)	
The case	2,960
Control (n = 5)	373 \pm 62

with an elevated alanine aminotransferase (ALT) level of 352 IU/L (reference range; 10-118 IU/L) and a low albumin level of 2.2 g/dL (reference range: 2.5-4.4 IU/L). Hemoglobi-nuria and bilirubinuria were observed on urinalysis. Radio-graphic examination showed a bulge in the pulmonary trunk and tortuous pulmonary arteries (Fig 1). These findings, taken together, lead to a diagnosis of severe class 3 (10). The dog's plasma NT-proBNP concentration was 2,960 pmol/L. Five normal Korean Jindo dogs, of the same age and sex, were evaluated and had a mean plasma NT-proBNP concentration of 373 pmol/L (Table 1).

Discussion

The Jindo breed is thought to have existed for several cen-turies on Jindo Island, located off the south-western point of Korea. This breed is hardy, brave, alert, and extremely loyal to its human owner (4).

Korea is an enzootic region for *D. immitis* (11,12). Recent antigen testing in several Korean provinces, conducted between 2001 and 2002, revealed a 40% prevalence of heartworm infection in these dogs (11). A recent paper reported a decrease in canine heartworm infection between 2007 and 2008, although the incidence of exposure to this nematode among dogs remains high at 20.9% (12). Characteristic radiographic findings of dirofilariasis include a bulge in the pulmonary trunk and pulmonary arteries that are enlarged and tortuous, with peripheral blunting (9). Our Jindo dog exhibited both a pulmonary trunk bulge and tortuous pulmo-nary arteries. On physical examination, tachycardia was noted (heart rate > 170 beats per minute). The tachycardia was thought to be most likely associated with congestive heart failure. Dirofilariasis of this dog was diagnosed as class 3 by clinical signs, blood chemical, radiographic and ELISA kit examination, although we didn't perform the echocardiographic examination.

NT-proBNP is synthesized mainly in the ventricular myocar-dium, in response to myocardial wall stress (9). NT-proBNP is released from the heart muscle in proportion to the severity of heart stretch and stress, and is therefore correlated with the degree of cardiac distention and congestion, and the level in the circulation provides information that can aid in the man-agement of patients with heart murmurs. NT-proBNP levels are elevated in dogs and cats with common heart diseases such as mitral valve endocarditis, cardiomyopathy, and aor-tic stenosis (10). Plasma NT-proBNP may also be useful in predicting disease progression in dogs with chronic mitral

valve insufficiency (7).

We hypothesized that NT-proBNP levels would be ele-vated in dogs with severe dirofilariasis leading to congestive heart failure. Haßdenteufel *et al.* (5) reported that a plasma NT-proBNP concentration of < 500 pmol/L is seen in dogs with no relevant cardiac load, 500-900 pmol/L represents a moderate cardiac load, and > 900 pmol/L represents severe cardiac load. Our dog's plasma NT-proBNP concentration of 2,960 pmol/L was extremely high, compared with the Jindo dogs that did not have dirofilariasis or any other disease. Nel-son and Couto (9) reported that azotemic dogs have increased NT-proBNP levels; however, our dog's blood urea nitrogen and creatinine were within the normal range.

Checking NT-proBNP concentration, along with the other testing used for the diagnosis of canine dirofilariasis such as thoracic radiography, echocardiography, and electrocardio-graphy, is important, and shows promise as an additional diagnostic method for heartworm infection (10).

To the best of our knowledge, this is the first report of plasma NT-proBNP elevation in a Korean Jindo dog with severe *D. immitis* infection. Further study is needed to inves-tigate the large scale survey and relationship of plasma NT-proBNP concentration to the severity of canine dirofilariasis.

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심장사상충 감염 진도견에서 혈장 NT-proBNP 농도 증가 증례

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요 약 : 본 증례는 충남대학교 수의과대학 부속동물병원에 내원한 심장사상충에 중감염된 2세, 암컷의 진도견에서 혈장 NT-pro BNP농도를 측정하였다. 심장사상충 감염은 신체검사, 혈액검사, ELISA 키트검사 및 영상진단검사 등으로 진단하였다. 본 증례 진도견의 혈장 NT-pro BNP농도는 심장사상충에 감염되지 않고, 다른 질병도 없는 5마리(모두 2세, 모두 암컷)의 정상견과 비교하였을 때, 상대적으로 매우 높은 수치를 나타내었다 (정상견 평균: 373 pmol/L, 본 증례: 2,950 pmol/L). 본 연구는 우리가 아는 한 심장사상충에 감염된 진도견에서 혈장 NT-pro BNP농도를 측정하여 보고한 최초의 증례보고이다.

주요어 : 심장사상충증, NT-proBNP, 개.